Long-Term Variable Milfoil Management and Control Plan for LAKE MASSASECUM Bradford, New Hampshire Merrimack County

Prepared by: New Hampshire Department of Environmental Services (DES), March 2009

PROBLEM STATEMENT

Exotic aquatic plants pose a threat to the ecological, aesthetic, recreational, and economic values of lakes and ponds (Luken & Thieret, 1997, Halstead, 2000). According to the 2006 Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology (CALM), "exotic macrophytes are non-native, fast growing aquatic plants, which can quickly dominate and choke out native aquatic plant growth in the surface water. Such infestations are in violation of Env-Ws 1703.19, which states that surface waters shall support and maintain a balanced, integrated and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region" (DES, 2006).

Though exotic aquatic plants can negatively impact an aquatic system, native aquatic plants are beneficial to the aquatic ecology of waterbodies. Diverse assemblages of native aquatic plants are a source of oxygen to the system, they provide stabilizing root systems to minimize erosion and turbidity, and they provide food and habitat for aquatic life.

Variable milfoil (*Myriophyllum heterophyllum*) became established in Lake Massasecum in Bradford, New Hampshire in 1996. In the span of two years it covered the majority of the northern 10 acres of the lake with large dense patches of growth in 4-10 feet of water. Figure 1 illustrates the distribution of variable milfoil infestations in this waterbody as of fall 2008.

In terms of the impacts of the variable milfoil in the system, there are several (at least 70) houses around the shoreline of Lake Massasecum, with mostly seasonal cottages, though there are a few year-round dwellings. There are also ten or more back lots with lake rights. Most of these properties are directly unaffected by the variable milfoil growth, and only those at the northern end of the lake directly abut the milfoil infestation. Unfortunately, occasional milfoil fragments do drift and settle in other parts of the waterbody, and if unnoticed can lead to an expanded infestation in the lake.

Lake residents at the northern end have expressed frustration with the exotic plant growth, citing fouling of their swim beaches, swim impairments, and concerns about the whole pond being choked with the invasive plant over time. Additionally, the invasive plant infestation in this waterbody is a continuous threat to the Warner River, which Lake Massasecum flows into.

The invasive plant infestation in this pond has continued to be problematic in the northern end, despite many non-chemical approaches at control. Lake Massasecum has a relatively shallow mean depth and ample habitat to support milfoil growth.

PURPOSE

The purposes of this exotic aquatic plant management and control plan are:

1. To identify the waterbody's beneficial use areas, including essential aquatic habitat, designated conservation zones, swimming areas, boat access sites, and boating use areas;
2. To present the aquatic macrophyte distribution map, including both native and exotic species;
3. To identify short-term and long-term exotic aquatic plant control goals that protect and conserve the lake's beneficial uses;
4. To recommend exotic plant control actions that meet the goals outlined in this plan; and
5. To recommend monitoring strategies to determine the success of the control practices over time in meeting the goals.

This plan also summarizes the current physical, biological, ecological, and chemical components of Lake Massasecum and the social and ecological impacts of the variable milfoil infestation. The intent of this strategic plan is to eradicate variable milfoil from Lake Massasecum over time through the use of Integrated Pest Management Strategies (IPM), staring with an herbicide treatment (2,4-D) to shrink the overall infestation so that it can be better managed by non-chemical controls in future years. Appendix A details the strategies available for waterbodies with exotic species, and provides more information on each of the activities that are recommended within this plan.

GOALS/OBJECTIVES OF MILFOIL CONTROL ACTIONS

The aquatic plant management plan for Lake Massasecum outlines actions to eradicate variable milfoil while maintaining native plant communities whenever variable milfoil control actions are being implemented.

The goal for Lake Massasecum is the eventual eradication of variable milfoil from the system using an Integrated Pest Management Approach. To achieve this goal, we recommend the following:

In 2009:

- Use an aquatic herbicide (2,4-D) to reduce growths of variable milfoil in the north end of the lake and a small segment of the outlet channel. A rate of 200 lbs/acre is recommended in the eastern half of the cove due to dense growths of variable milfoil. This is an older area that has not been managed for some time and the root crowns are rather hardy, necessitating a higher treatment rate. A treatment rate of 100 lbs/acre is recommended for the western half where milfoil is less dense and other non-chemical management practices have attempted to reduce growths in recent years.
- Perform follow-up monitoring and hand-removal and/or diver assisted suction harvesting activities to removal any persistent or recurring growth following herbicide treatment.
- Maintain an active Weed Watcher Program to track re-growth and advise divers on where to hand-remove growth.

Town Support

The Town of Bradford has been very supportive of variable milfoil control efforts in Lake Massasecum for the past several years. The town has generously awarded funds for projects dealing with prevention activities (the Lake Host Program) and control activities (hand-removal projects and fragment barrier net construction).

This is the only infested waterbody in the town at this point, and the town officials recognize the need to protect other nearby waterbodies.

The town has voted on and approved an allocation of funding in 2009 for an aquatic herbicide treatment of variable milfoil in Lake Massasecum.

Lake Massasecum Improvement Association (LMIA) Support

Lake Massasecum has an experienced and active lake association that has contributed both time and funds to control variable milfoil in the lake. The Lake Association has coordinated the installation and the removal of fragment barriers in the north end each year, the placement of benthic barriers, the hiring of divers, and numerous other activities.

The LMIA has earmarked lake association funds to match town funds to pay for the herbicide treatment and other control activities on Lake Massasecum in 2009.

WATERBODY CHARACTERISTICS

The following table summarizes basic physical and biological characteristics of Lake Massasecum.

General Lake Information	
Lake area (acres)	401.5
Watershed area (acres)	6,041
Shoreline Uses (residential, forested, agriculture)	Residential, forested
Max Depth (ft)	54
Mean Depth (ft)	12.5
Trophic Status	Mesotrophic
Color (CPU) in Epilimnion	18
Clarity (ft)	13.2
Flushing Rate (yr^{-1})	2
Natural waterbody/Raised by Damming/Other	Natural
Plant Community Information Relative to Management	
Invasive Plants (Latin name)	*Myriophyllum heterophyllum*
Infested Area (acres)	Approximately 12.5 acres
Distribution (ringing lake, patchy growth, etc)	Moderate to dense patchy growth in northern end of lake
Sediment type in infested area (sand/silt/organic/rock)	Silty/sandy

Rare, Threatened, or Endangered Species in Waterbody (according to NH Natural Heritage Inventory)	Pink bog button (*Sclerolepsis uniflora*)

An aquatic vegetation map and key from a summer 2005 lake assessment survey by the DES Biology Section is shown in Figure 2. A bathymetric map is shown in Figure 3.

BENEFICIAL (DESIGNATED) USES

In New Hampshire, beneficial (designated) uses of our waterbodies are categorized into five general categories: Aquatic Life, Fish Consumption, Recreation, Drinking Water Supply, and Wildlife (CALM).

Of these, Aquatic Life and Recreation are the ones affected by the presence of invasive plants like variable milfoil.

AQUATIC LIFE

The goal for aquatic life support is to provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of the region.

FISHERIES AND WILDLIFE

Lake Massasecum is managed for warmwater fish species. Fish species present include largemouth bass, smallmouth bass, chain pickerel, black crappie, brown bullhead, yellow perch, common sunfish, redbreast sunfish, common white sucker, common shiner, golden shiner, mummichog and American eel.

Fishing pressure is light during both open-water and winter, but bass fishing is quite good.

An abundance of mussels mussels were observed in the sandier substrates at the southern end of the lake.

RECREATION USES AND ACCESS POINTS

Lake Massasecum is used for numerous recreational activities, including boating, fishing, swimming, and water skiing by both pond residents and transient boaters. There is one designated public access for boats on the western side of the pond. Motor boats, as well as kayaks and canoes can use this facility. There is limited parking for about two or three vehicles with trailers along Route 114 near the launch.

There are two public (town) beaches on the pond (also called “designated beach”). A designated beach is described in the CALM as an area on a waterbody that is operated for bathing, swimming, or other primary water contact by any municipality, governmental

subdivision, public or private corporation, partnership, association, or educational institution, open to the public, members, guests, or students whether on a fee or free basis. Env-Wq 1102.14 further defines a designated beach as *"a public bathing place that comprises an area on a water body and associated buildings and equipment, intended or used for bathing, swimming, or other primary water contact purposes. The term includes, but is not limited to, beaches or other swimming areas at hotels, motels, health facilities, water parks, condominium complexes, apartment complexes, youth recreation camps, public parks, and recreational campgrounds or camping parks as defined in RSA 216-I:1, VII. The term does not include any area on a water body which serves 3 or fewer living units and which is used only by the residents of the living units and their guests.*

In addition to the designated beach, there are a few small private swim beaches located on private properties around the pond and scattered docks and swim platforms on the lake.

MACROPHYTE EVALUATION

The littoral zone is defined as the nearshore areas of a waterbody where sunlight penetrates to the bottom sediments. The littoral zone is typically the zone of rooted macrophyte growth in a waterbody.

The littoral zone of Lake Massasecum is characterized by a mix of native and non-native (variable milfoil) plant growth (Figure 2). Native species include a mix of floating plants (watershield, floating heart, white water-lily, yellow water-lily), emergent plants (pickerelweed, bulrush, water lobelia), and submergent plants (bladderwort, pondweed, pink bog button). Native plant communities are mixed around the entire lake, and are characterized as 'common/abundant' by the DES.

While the most recent NHB review did not show any rare, threatened or endangered plant species, pink bog button (*Sclerolepsis uniflora*) is present in this pond. The plant is at the northern extent of its range in NH, and is only present in Lake Massasecum in this state. The plant can be categorized as common/abundant throughout the lake however, particularly in the southern end. Control activities in the northern end of the lake are not expected to impact this plant, as the outlet channel flows out of the north end of the lake, so herbicide will not drift into the lake following treatment, but rather away from the main body of the lake. Also, much of the *Sclerolepsis* that was present in the north end of the pond has been greatly reduced through competition by the variable milfoil, which competes for habitat and shades out the *Sclerolepsis*.

HISTORICAL CONTROL ACTIVITIES ON THIS WATERBODY:

Contractor	Management Type:	Date	Area (acres)	Effectiveness
Aquatic Control Technology, Inc.	Herbicide: Diquat	June 11, 1997	11 acres	Diquat did not provide effective long-term control and regrowth was rapid following treatment.

In addition to the herbicide treatment conducted in 1997, the local lake association and the town have coordinated numerous mechanical harvesting, diving, suction harvesting, and covering (with benthic barrier) activities in the north end of the lake in the last 12 years.

MILFOIL MANAGEMENT OPTIONS

The control practices used should be as specific to variable milfoil as feasible. No control of native aquatic plants is intended.

Exotic aquatic plant management relies on a combination of proven methods that control exotic plant infestations, including physical control, chemical control, biological controls (where they exist), and habitat manipulation. Integrated Pest Management Strategies (IPM) are typically implemented using Best Management Practices (BMPs) based on site-specific conditions so as to maximize the long-term effectiveness of control strategies. Descriptions for the control activities are closely modeled after those prescribed by the Aquatic Ecosystem Restoration Foundation (AERF) (2004). This publication can be found online at http://www.aquatics.org/aquatic_bmp.pdf.
Criteria for the selection of control techniques are presented in Appendix A. Appendix B includes a summary of the exotic aquatic plant control practices used by the State of New Hampshire. DES has evaluated the feasibility of potential control practices on Lake Massasecum. The following table summarizes DES' control strategy recommendations for Lake Massasecum.

FEASIBILITY EVALUATION FOR CONTROL ALTERNATIVES

Control Method	Use on Lake Massasecum
Restricted Use Areas	A Restricted Use Area has been in place at the northern end of Lake Massasecum since 1998. A fragment barrier and state regulatory buoys mark the location in the lake. The fragment barrier is cleaned of fragments regularly by local lake residents.
Hand-pulling	Hand-pulling activities have been conducted annually since 1998, unfortunately the milfoil infestation has been too big to reasonable control or reduce through this method. Hand-pulling and diver-assisted suction harvesting may be used as follow-up control practices following treatment.
Mechanical Harvesting/Removal	Lake Massasecum is one lake where mechanical harvesting has been permitted. The LMIA, with Wetlands Bureau permission, has been mechanically harvesting variable milfoil since ~2000. The lake association contracted the construction of a pontoon boat equipped with a cutter bar and containment net so that hired contractors could cut milfoil off just above the sediments 2-3 times each year to reduce fragmentation in the cove. This was only a short-term control method though, and not expected to control the plants by the roots.
Benthic Barriers	Benthic barriers have been used from time-to-time in Lake

Control Method	Use on Lake Massasecum
	Massasecum, with moderate to good success. Unfortunately the milfoil infestation is too large to use this method throughout the cove, and more substantial and longer-term methods are needed at this time. These could be used once again to control smaller growth that may persist following treatment.
Herbicides	For Lake Massasecum 2,4-D is the recommended herbicide, and recommended treatment method. The variable milfoil covers just over 12 acres of the pond with moderate to dense growth, and for follow-up non-chemical approaches to be effective, an herbicide treatment is warranted to reduce this overall growth to a level that is manageable. It is recommended that a rate of 200 lbs/acre be used in the eastern half of the treatment area due to dense growth of mature plants with hardy root crowns. A 100 lb/acre rate is recommended for the western half of the treatment area.
Extended Drawdown	Drawdown is not an effective control method for variable milfoil and not feasible in this system.
Dredge	Not recommended due to nature of exotic plant distribution, the cost, or the ancillary ecological impacts that the dredge could have.
Biological Control	There are no approved biological controls for variable milfoil at this time in New Hampshire.
No Control	In order to allow for a healthy stand of mixed native aquatic vegetation, including the rare *Sclerolepsis* in the lake to thrive, and for downstream areas to be milfoil free, a 'No Control' option is not recommended. Without control, variable milfoil will eventually take over 100% of the littoral zone of Lake Massasecum, and could extend into slightly deeper waters.

EXOTIC AQUATIC PLANT CONTROL PLAN

An evaluation of the size, location, and type of variable milfoil infestation, as well as the waterbody uses was conducted by DES during September 2008. Based on the evaluation, the following control actions are recommended:

Year	Action	Responsible Party	Schedule
2009	2,4-D treatment in approximately 12 acres at the northern end of the pond, as shown in Figure 1. See notation in table above regarding various rates.	Aquatic Control Technology, Inc.	June
	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	DES or contract divers	July through September
	Installation of benthic barriers, as may be appropriate	DES and/or contract divers	July/August

Year	Action	Responsible Party	Schedule
	Weed Watching and Lake Hosting Activities	Lake Massasecum Association and lake residents	June through September
	Site assessment and remapping of variable milfoil infestation	Aquatic Control Technology, Inc. (through research project)	August/September
2010	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	DES or contract divers	July through September
	Installation of benthic barriers, as may be appropriate	DES and/or contract divers	July/August
	Weed Watching and Lake Hosting Activities	Lake Massasecum Association and lake residents	June through September
2011	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	DES or contract divers	July through September
	Installation of benthic barriers, as may be appropriate	DES and/or contract divers	July/August
	Weed Watching and Lake Hosting Activities	Lake Massasecum Association and lake residents	June through September
2012	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	DES or contract divers	July through September
	Installation of benthic barriers, as may be appropriate	DES and/or contract divers	July/August
	Weed Watching and Lake Hosting Activities	Lake Massasecum Association and lake residents	June through September
2013	SCUBA inspection and diver hand-removal of variable milfoil at individual points and at areas of reduced percent coverage as a result of herbicide application	DES or contract divers	July through September
	Installation of benthic barriers, as may be appropriate	DES and/or contract divers	July/August
	Weed Watching and Lake Hosting Activities	Lake Massasecum Association and lake residents	June through September

Year	Action	Responsible Party	Schedule
	Site assessment and remapping of variable milfoil infestation	DES	August/September
2014	Update and revise Long-Term Variable Milfoil Control Plan	NH DES, F&G, and interested parties	Spring 2012

- Approximately 12 acres of the waterbody will be impacted by the herbicide treatment (approximately 2.9% of the surface area).

- The Department of Agriculture will impose standard short-term use restrictions for specified days depending on the use (irrigation, contact, etc) and the herbicide used. The shoreline will be posted and public notice will be made.

- By recommending follow-up management practices that utilize integrated plant management strategies such as benthic barrier placement and hand-pulling re-growth, variable milfoil re-growth or population expansion can be slowed, especially following an herbicide treatment that will greatly reduce the current footprint of variable milfoil growth. The lake association and the town of Bradford have committed funds and diver assistance towards this project.

- Based on the types of native plants that are mixed in with the stands of variable milfoil (Figure 2) where herbicide application is recommended there are no significant impacts to native plant communities. It is expected that a well distributed stand of native aquatic plants will remain following herbicide application.

- It is important to realize that aquatic herbicide applications are conducted in a specific and scientific manner, and that the herbicides that are used can be target-specific when used at appropriate doses/concentrations: this means that the invasive plant can be removed and native plants favored in this type of control practice. *Not all aquatic plants will be impacted as a result of an herbicide treatment.*

- Because this is a natural system that is being evaluated for management, it is impossible to accurately predict a management course over five years that could be heavily dependent on uncontrolled natural circumstances (weather patterns, temperature, etc). This management plan should be considered a dynamic document that is geared to the actual field conditions that present themselves in this waterbody. If circumstances arise that require the modification of part or all of the recommendations outline here, all interested parties will be consulted for their input on revisions that may be needed to further the goal of variable milfoil management in the subject waterbody.

Figure 1- Map of Variable Milfoil Infestation

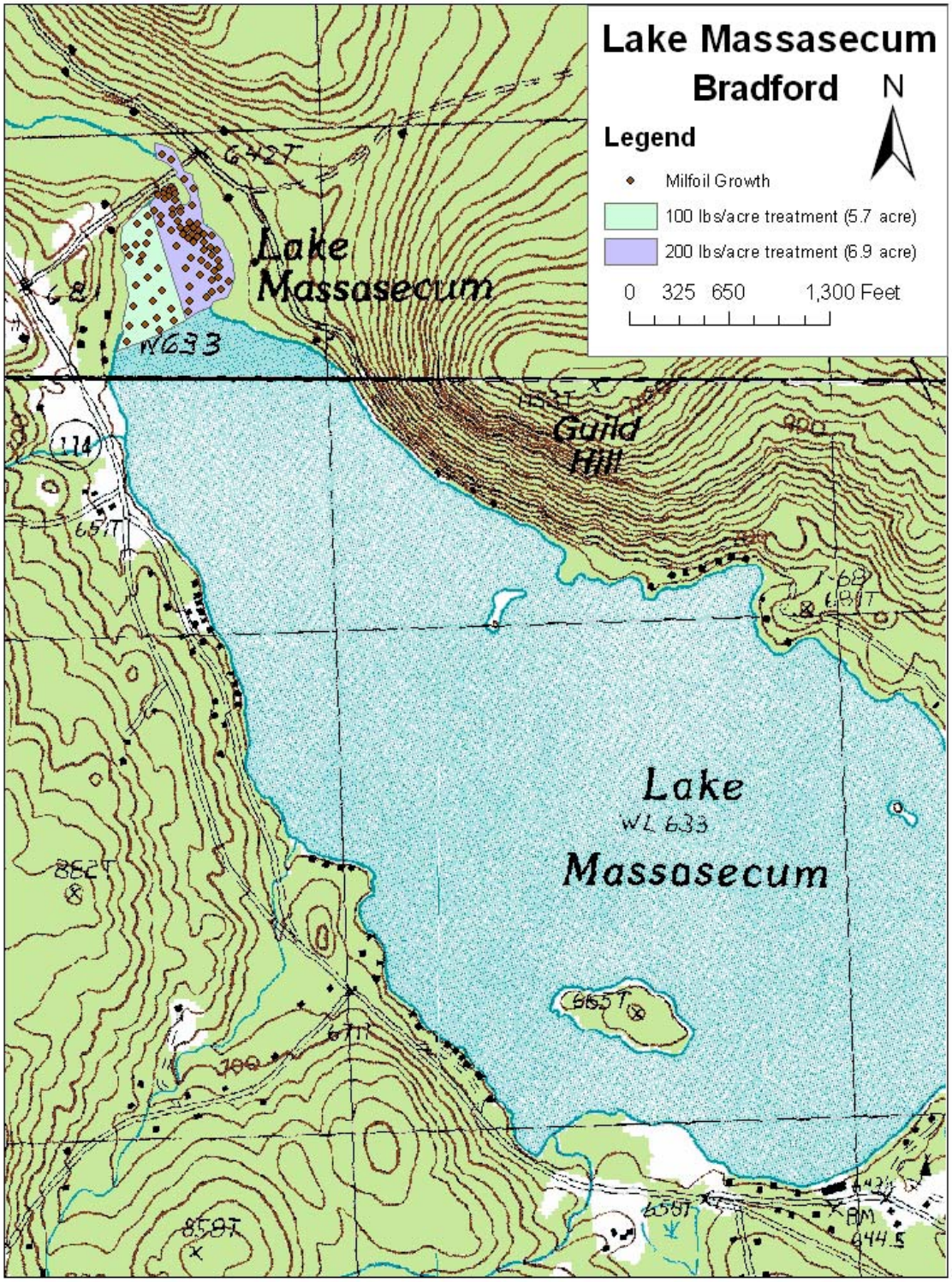
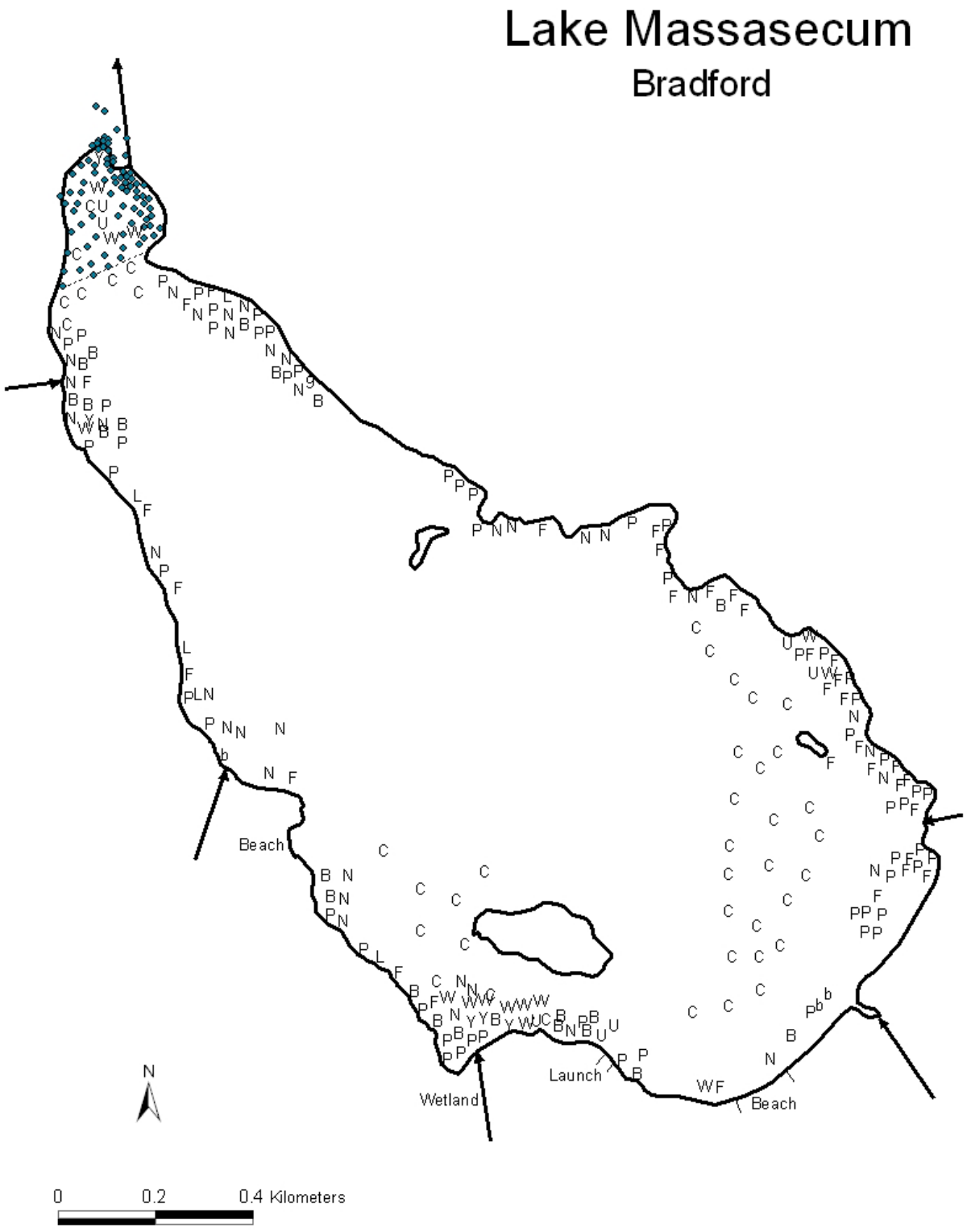
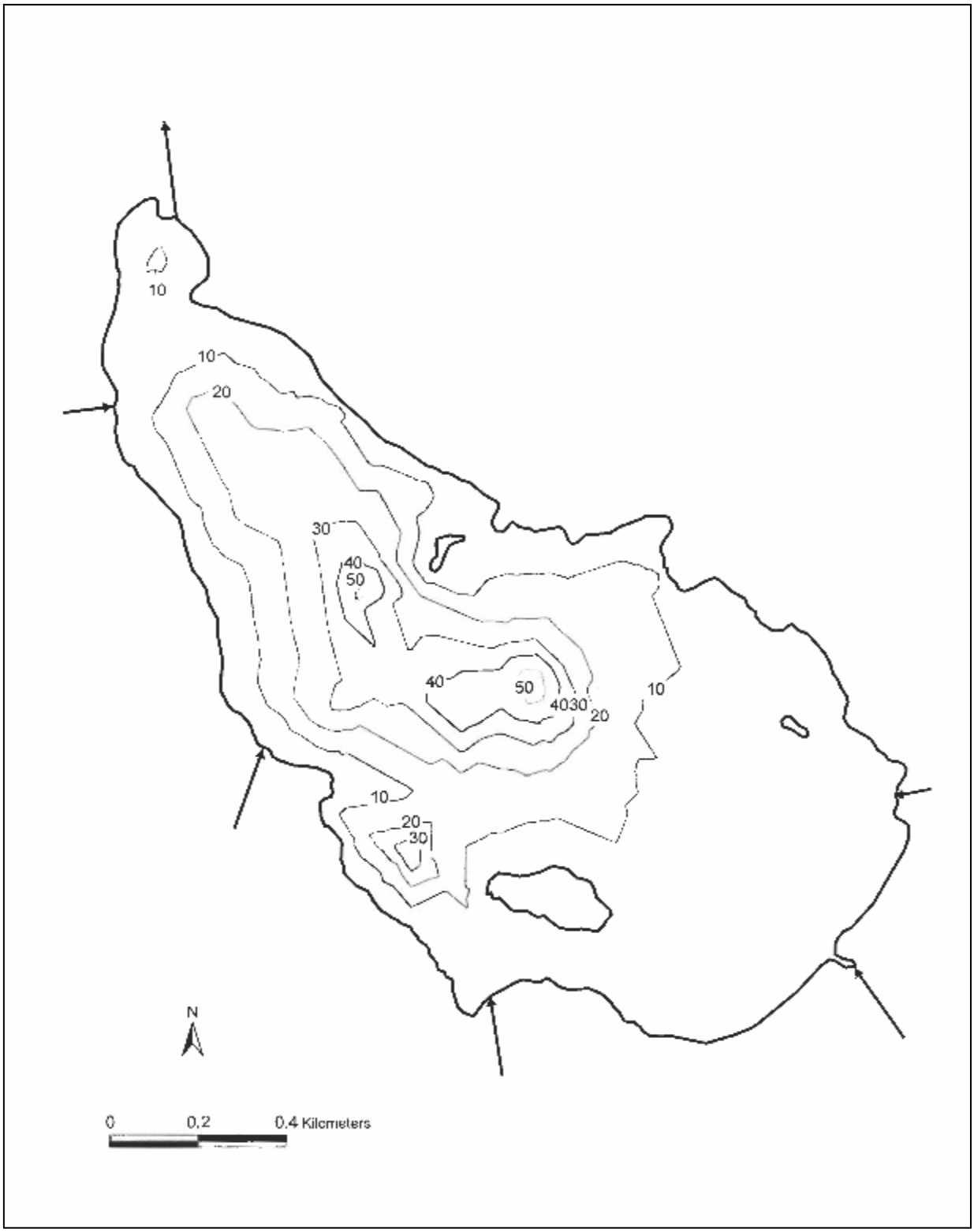


Figure 2- Aquatic Vegetation Map and Key



Plant Key for Lake Massasecum		
Symbol	**Common Name**	**Latin Name**
C	Pink bog button	*Sclerolepsis uniflora*
P	Pickerelweed	*Pontedaria cordata*
B	Watershield	*Brasenia schreberi*
W	Pondweed	*Potamogeton*
F	Floating heart	*Nymphoides cordatum*
N	White water-lily	*Nymphaea*
b	Softstem bulrush	*Scirpus validus*
U	Bladderwort	*Utricularia*
L	Water lobelia	*Lobelia dortmanna*
Y	Yellow water-lily	*Nuphar*
•	Variable milfoil	*Myriophyllum heterophyllum* (present in north end of lake, documented by GPS point coverage shown in Figure 1, and in Figure 2).

Figure 3- Bathymetric Map of Lake Massasecum, Bradford



APPENDIX A

CRITERIA TO EVALUATE THE SELECTION OF AQUATIC PLANT CONTROL TECHNIQUES

Preliminary Investigations

I. Field Site Inspection

- Verify genus and species of the plant.
- Determine if the plant is a native or exotic species per RSA 487:16, II.
- Map extent of the plant infestation (area, water depth, height of the plant, density of the population).
- Document any native plant abundances and community structure around and dispersed within the exotic/nuisance plant population.

II. Office/Laboratory Research of Waterbody Characteristics

- Contact the appropriate agencies to determine the presence of rare or endangered species in the waterbody or its prime wetlands.
- Determine the basic relevant limnological characteristics of the waterbody (size, bathymetry, flushing rate, nutrient levels, trophic status, and type and extent of adjacent wetlands).
- Determine the potential impacts to downstream waterbodies based on limnological characteristics (water chemistry, quantity, quality).

Overall Control Options

For any given waterbody that has an infestation of exotic plants, one of three options will be selected, based on the status of the infestation, the available management options, and the technical knowledge of the DES Limnologists who have conducted the field work and who are preparing this plan. The options are as follows:

1) Eradication: Herbicide application targeted at exotic aquatic plant to be eradicated, to either eradicate the plant or to reduce overall biomass to a point where alternative non-chemical strategies may be used. This action will be followed by thorough annual monitoring for regrowth and the use of non-chemical actions to achieve the eradication.

2) Containment: The aim of this approach is to limit the size and extent of the existing infestation. An herbicide application may be used to reduce specified areas down to a percent cover of the exotic species so that it can be maintain or contained with alternative management strategies, including Restricted Use Areas, benthic barriers, and others. Subsequent herbicide applications may be necessary if the target species shows exponential growth and further spread.

3) No action. If the infestation is too large, spreading too quickly, and past management strategies have proven ineffective at controlling the target exotic aquatic plant, DES, in consultation with others, may elect to recommend 'no action' at a particular site. All efforts will instead be made towards containment of the target species to that specific waterbody, so that downstream migration of the plant can be prevented.

If eradication or control is the recommended option to pursue, the following series of control techniques may be employed. The most appropriate technique based on the determinations of the preliminary investigation will be selected.

Guidelines and requirements of each control practice are detailed below each alternative.

A. Hand-Pulling

- Can be used for exotic or native species.
- Can be used if infestation is in a small localized area (sparsely populated patch of up to 5' X 5', single stems, or dense small patch up to 2' X 2').
- Can be used if plant density is low, or if target plant is scattered and not dense.
- Can be used if the plant could effectively be managed or eradicated by hand-pulling a few scattered plants.
- Use must be in compliance with the Wetlands Bureau rules.

B. Mechanically Harvest or Hydro-Rake

- Can not be used on plants which reproduce vegetatively by fragmentation (e.g., milfoil, fanwort, etc.) unless containment can be ensured.
- Can be used only if the waterbody is accessible to machinery.
- Can be used if there is a disposal location available for harvested plant materials.
- Can be used if plant depth is conducive to harvesting capabilities (~ <7 ft. for mower, ~ <12 ft. for hydro-rake).
- Funds are available for repeated harvesting activities in that season.
- A navigation channel is required through dense plant growth.

C. Chemical Treatment

- Can be used if application of chemical is conducted in areas where alternative control techniques are not optimum due to depth, current, use, or type of plant.
- Can be used for treatment of exotic plants where fragmentation is a high concern.
- Can be used where species specific treatment is necessary due to the need to manage other plants (rare or endangered that will not be impacted by chemical treatment).
- Can be used if other methods used as first choices in the past have not been effective.
- A licensed applicator should be contacted to inspect the site and make recommendations about the effectiveness of chemical treatment as compared with

other treatments.

D. Restricted Use Areas (per RSA 487:17, II (d))

- Can be used for exotic species only.
- Can be established in an area that effectively restricts use to a small cove, bay, or other such area where navigation, fishing, and other activities may cause fragmentation to occur.
- Can not be used when there are several "patches" of an infestation of exotic aquatic plants throughout a waterbody.
- Can be used as a temporary means of control.

E. Bottom Barrier

- Can be used for exotic or native species.
- Can be used in small areas, preferably less than 10,000 sq. ft.
- Can be used in an area where the current is not likely to cause the displacement of the barrier.
- Can be used early in the season before the plant reaches the surface of the water.
- Can be used in an area to compress plants to allow for clear passage of boat traffic.
- Can be used in an area to compress plants to allow for a clear swimming area.

F. Drawdown

- Can be used if the target plant(s) are susceptible to drawdown control.
- Can be used in an area where bathymetry of the waterbody would be conducive to an adequate level of drawdown to control plant growth, but where extensive deep habits exist for the maintenance of aquatic life such as fish and amphibians.
- Can be used where plants are growing exclusively in shallow waters where a drawdown would leave this area "in the dry" for a suitable period of time (over winter months) to control plant growth.
- Can be used in winter months to avoid encroachment of terrestrial plants into the aquatic system.
- Can be used if it will not significantly impact adjacent or downstream wetland habitats.
- Can be used if spring recharge is sufficient to refill the lake in the spring.
- Can be used in an area where shallow wells would not be significantly impacted.
- Reference RSA211:11 with regards to drawdown statutes.

G. Dredge

- Can be used in conjunction with a scheduled drawdown.
- Can be used if a drawdown is not scheduled, though a hydraulic pumping dredge should be used.
- Can only be used as a last alternative due to the detrimental impacts to

environmental and aesthetic values of the waterbody.

H. Biological Control

- Grass carp cannot be used.
- Exotic controls, such as insects, cannot be introduced to control a nuisance plant.
- Research should be conducted on a potential biological control prior to use to determine the extent of host specificity.

APPENDIX B

SUMMARY OF CONTROL PRACTICES USED IN THE STATE OF NEW HAMPSHIRE FOR EXOTIC AQUATIC PLANTS

Restricted Use Areas:

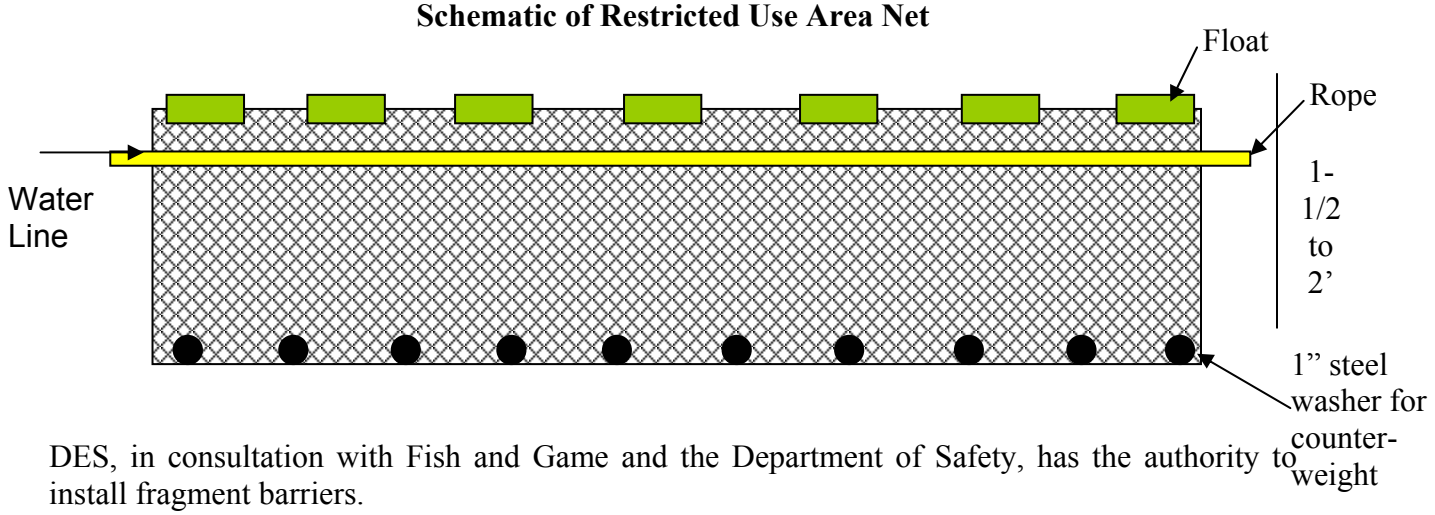
Restricted Use Areas (RUAs) are a control option for lakes with small, contained infestations of exotic plants, limited to small patches or embayments. This is often the case in waterbodies with newly-discovered infestations or in waterbodies where control practices have reduced an infestation to a small isolated area. RUAs are a legal designation that restricts access to all recreational activities in a delineated area to minimize plant fragmentation and thereby reduce the spread of milfoil. These areas are cordoned off with regulatory buoys that indicate the restriction.

DES, in consultation with the Department of Safety, has the authority to install RUAs.

Fragment Barriers:

Fragment barriers can be used alone or in combination with a RUA. Fragment barriers are a method of protection from fragment migration. The fragment barrier is constructed of a shallow net that is held vertically in the water column with a combination of floats at the top and counterweights along the bottom of the net. The net is approximately 1.5-2.0 feet in height and does not reach to the bottom of the waterbody. The top of the net is set to extend four inches above the surface of the water, while the remainder is positioned below the surface of the water (see figure below). This configuration prevents the movement of floating fragments from infested areas to uninfested areas. Due to the size and nature of net construction, there is no impediment to fish migratory patterns or spawning activities.

Schematic of Restricted Use Area Net



DES, in consultation with Fish and Game and the Department of Safety, has the authority to install fragment barriers.

Hand-pulling:

When infestations of exotic aquatic plants begin as single scattered stems or small patches, DES biologists or other specially licensed individuals SCUBA dive to selectively hand-pull the exotic plants.

The whole plant, including the roots, should be removed in this process, while leaving the beneficial native species intact. This technique works best in softer sediments, with shallow rooted species and for smaller, scattered infestation areas. When hand pulling nuisance species, the entire root system and all fragments of the plants must be collected and put into a fine mesh net dive bag since small root or stem fragments could result in additional growth of the species. The process must be repeated often to control re-growth of the exotic plants. For a new infestation, hand-pulling activities are typically conducted several times during the first season, with follow-up inspections for the next 2-5 years or until no re-growth is observed.

This control practice has proven successful in many waterbodies at eliminating exotic plants before they form a large infestation.

DES divers and individuals holding a specialty Weed Control Diver (WCD) certification can perform hand-pulling activities without a permit. All others seeking to hand remove aquatic plants should consult the DES Wetlands Bureau to determine if a permit is needed.

Diver Assisted Suction Harvesting

Diver Assisted Suction Harvesting (DASH) is a method whereby a diver works to hand remove exotic plants from the bottom sediments, and rather than depositing them into a dive bag for containment, they are fed into a suction tube that brings the materials topside for containment, de-watering, and disposal. This method can allow for larger-scale removal projects and potentially lower turbidity than simple diving and hand-removal with a dive bag.

Generally, the DASH unit is comprised of a floating platform that is set up with a suction pump and associated hoses, and some type of catchment basin that is lined with fine mesh net to entrain the plants and to filter the water through and back into the lake.

A team comprised of one or two divers and one or two topside tenders are needed to operate the DASH unit.

Only DES divers and individuals holding a specialty WCD certification and that have been trained on DASH can perform suction harvesting activities without a permit.

Mechanical Harvesting

The process of mechanical harvesting is conducted by using machines which cut and collect aquatic plants, much like a lawnmower cuts grass. These machines can cut the plants up to twelve feet below the water surface. The weeds are cut and then collected by the harvester or other separate conveyer-belt driven device where they are stored in the harvester or barge, and then transferred to an upland site for disposal.

The advantages of this type of weed control are that cutting and harvesting immediately opens an area such as boat lanes or swim areas, and it removes the upper portion of the plants.

Due to the size of the equipment, mechanical harvesting is limited to water areas of sufficient size and depth. It is important to remember that mechanical harvesting can leave plant fragments in the water, which if not collected, may spread the plant to new areas; therefore this technique is generally not recommended for milfoil, fanwort, and other plants that spread by vegetative means. Additionally harvesters may impact fish and insect populations in the area by removing them in harvested material. Cutting plant stems too close to the bottom can result in re-suspension of bottom sediments and nutrients. This management option is only recommended when nearly the entire waterbody is infested, and harvesting is needed to open navigation channels through the infested areas.

DES will make a determination on the feasibility of performing this technique. Permits will be needed for any mechanical removal projects.

Benthic Barriers:

When a small infestation of exotic aquatic plants occurs in clusters of growth as opposed to scattered stems, a permeable fiberglass coated screen material can be placed over the area of infested lake sediments.

The permeable fabric screening allows for gas release from the sediments while effectively blocking sunlight and compressing the plants into the sediment, inhibiting photosynthesis and eventually killing the plant. Occasionally, in some lakes, gas release from the sediments or boating activity can cause the uplifting of screening, so it is critical to adequately secure the barriers to the sediments.

Benthic barriers have two basic applications. These practices are used to cover pioneering infestations and prevent the spread of the plant. Bottom barriers are installed across small portions of lake bottoms infested with invasive aquatic plants. The disadvantage of benthic barriers is that they are not selective in controlling just one species. There is also a limitation on how big of an area can or should be covered. Additionally, these physical barriers prevent the growth of all vegetation in an area, which is a necessary component of fish and wildlife habitat.

Bottom barriers are attached to the bottom of a water body by re-bar attached to the edges and across the middle of the material. Rocks or other heavy objects may also be used to anchor the barrier. Bottom barriers are transported to the shoreline adjacent to where installation is to occur. They are then cut to fit the treatment site and rolled onto a length of pipe. Divers carry the roll into the water at the start of the treatment site and secure one edge of the material to the lake bottom. The divers then roll out the remainder of the material and continue to secure it to the bottom sediments. This process is repeated until the plants in the treatment are covered.

Bottom barriers are generally considered for small localized areas rather than lakewide application. Bottom barriers provide 100% control of this weed in areas where they are installed. They also provide long-term control. An ongoing maintenance operation is required to inspect the bottom barrier and clear the mats of sediment buildup.

Benthic barriers are not recommended for application in river systems, as flow can easily uplift the barrier.

DES Wetlands permits may be needed for the installation of benthic barriers.

Targeted Application of Herbicides:

The use of as aquatic herbicides is often a consideration in a long-term plan to control an exotic plant, particularly if the infestation covers a number of acres within the subject waterbody, and other non-chemical controls have proven ineffective at reducing growths of the target plant.

In the last 15 to 20 years the use and review of herbicides has changed significantly in order to accommodate safety, health, and environmental concerns. Currently no herbicide product can be labeled for aquatic use if it has more than a one in a million chance of causing significant harmful effects to human health, wildlife, or the environment. Because of this, the number of effective and U.S. Environmental Protection Agency (EPA) approved herbicides for aquatic weeds are limited. In most cases the cost and time of testing and registration, rather than environmental issues, limits the number of potentially effective compounds. In addition to federal testing protocols, DES has funded research projects to further identify products which provide effective and long-term control of key exotic aquatic plants which are common in New Hampshire, with the overall goal of reduce the frequency of herbicide treatments because of extended control.

All herbicide applications in New Hampshire are performed under special aquatic permits issued by the New Hampshire Department of Agriculture, Division of Markets and Food, Bureau of Pesticide Control. Only specially licensed applicators can conducted these treatments.

Depending on the type of plant infestation DES will work with licensed applicators and other scientisits to determine the most appropriate herbicide for use in controlling the target plant species.

Extended Drawdown:

Water drawdown is used for control of some species of aquatic macrophytes. Drawdown requires some type of mechanism to lower water levels, such as dams or water control structures and use is thus limited. It is most effective when the drawdown depth exceeds the depth or invasion level of the target plant species.

In northern areas, drawdown will result in plant and root freezing during the winter for an added degree of control. Drawdown is typically inexpensive and has intermediate effects (2 or more years). However, drawdown can have other environmental effects and interfere with other functions of the waterbody (e.g. drinking water supply, aquatic life/ecology, recreation, or aesthetics). Drawdown can result in the rapid spread of highly opportunistic annual weed species, which in most cases is the plant that is targeted for control.

Drawdowns have been used in the past for plant control. In theory, the drying of the plants in the summer, or the freezing of the plants in the winter, will eliminate or limit plant growth. However, some exotic plants, like milfoil, often form a more succulent terrestrial form during drawdown conditions and the succulent form of the plant can remain viable for long periods of

time without submergence, making the practice ineffective. This strategy can be used for control of some native plant species, but is very dependent of weather conditions during the drawdown.

The DES Dam Bureau should be consulted prior to any drawdowns to determine proper notifications and other protocols for drawing down or altering flow of any waterbody.

Dredging

Dredging is a means of physically removing aquatic plants from the bottom sediments using a floating or land-based dredge. Dredging can create a variety of depth gradients creating multiple plant environments allowing for greater diversity in lakes plant, fish, and wildlife communities. However due to the cost, potential environmental effects, and the problem of sediment disposal, dredging is rarely used for control of aquatic vegetation alone.

Hydro-Raking

Hydro-raking is a technique to remove plants and their rooting systems. A device that resembles a floating back-hoe is outfitted with a York rake. The rake is drawn through the bottom sediments to remove root systems and above sediment biomass. A typical hydro-rake can operate in water as shallow as a few inches to a maximum of 12 feet. The material is off-loaded on shore or onto a barge for transport to shore. Hydro-raking can be effective on species like water-lilies or emergent plants with substantial root systems in the sediments. A hydro-raking operation can provide seasonal to 1-3 years of effective plant control, depending on the targeted species. An advantage to hydro-raking is the absence of chemical introduction to a waterbody. This makes hydro-raking appealing for clearing swimming areas, as well as boating and fishing lanes. Hydro-raking also minimizes shoreline impact because the entire operation takes place on the water. This operation is also much more cost effective than bottom dredging.

Hydro-raking projects would require a permit through the DES Wetlands Bureau.

Biological Control:

There are no approved biological controls for submersed exotic aquatic plant at that time in New Hampshire, though through research partnerships we are exploring possible future options. Significant research is required to ensure that any biological controls are safe for the environment, and that they will not pose more of a risk than the target species itself.

DES and the Department of Agriculture, among other agencies, would be involved if a biological control option is considered.

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